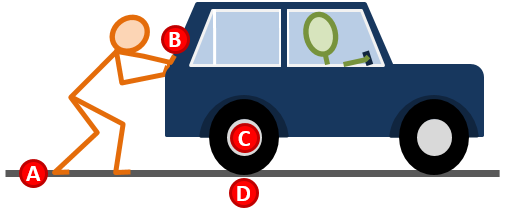
**Where’s friction?**

Alfie’s car won’t start and Mohammed is giving him a push start.



1. Where do you think there is friction?

For each statement, tick (✓) **one** column to show if you think there is friction there.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statements** | | I am **sure** this is right | I think this is right | I think this is wrong | I am **sure** this is wrong |
| **A** | Between Mohammed’s feet and the road |  |  |  |  |
| **B** | Between Mohammed’s hands and the car |  |  |  |  |
| **C** | Between moving bits of metal in the car |  |  |  |  |
| **D** | Between the tyres and the road |  |  |  |  |

*Physics > Big idea PFM: Forces and motion > Topic PFM1: Forces > Key concept PFM1.4: Friction*

|  |
| --- |
| **Diagnostic question** |
| **Where’s friction?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Friction is a force generated by an interaction between two surfaces, and which acts to resist movement between them. |
| Observable learning outcome: | * Identify places where the force of friction is acting. |
| Question type: | Diagnostic, confidence grid |
| Key words: | Friction, grip, rubbing |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

Friction is the force generated *by* an interaction between two objects. This is different to most forces which *cause* the interaction (Hart, 2002).

In a study of thirty-eight students, Stead and Osborne (1980) found that half of 13-year olds thought of friction as rubbing. In a later study, they also found that seventeen out of forty-seven secondary students think that friction depends on movement (Stead and Osborne, 1981). But friction also acts between objects that are not moving.

This diagnostic question helps to identify whether students can recognise friction acting when objects are not moving in relation to each other.

**Ways to use this question**

Students should complete the confidence grid individually. This could be a pencil and paper exercise, or you could use an electronic ‘voting system’ or mini white boards and the PowerPoint presentation.

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs.

Differentiation

You may choose to read the questions to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

There is friction acting in all four examples.

**How to respond - what next?**

1. As Mohammed pushes back on the road friction stops his foot from slipping by pushing forward on his foot. The harder he pushes, the harder friction pushes back up to a limit (after which his foot slips).
2. Friction stops his hands slipping on the back of the car.
3. As the wheels turn, friction caused by the axle rubbing on the bearings will slow down or oppose the movement.
4. If there was no friction the wheel would not rotate, it would slide across the surface without turning. The part of the tyre in contact with the road is not moving in relation to the road surface, rather the wheel rolls over the road.

If students find it hard to identify friction between objects that are not moving in relation to each other, then you could guide them through a simple practical activity:

Firstly they should press their hand down on the surface of a table and push it forwards at the same time, but without it sliding. They will experience the force of friction pushing back on their hands.

Next they should push down onto a piece of paper on the table. Keeping their hand still and pulling the piece of paper backwards, out from under their hand, will exert a backwards force on their hand. This should feel the same as the static friction force in the first part of this activity.

Following this activity, it may be appropriate to give students the opportunity to identify other sources of friction that they experience. Perhaps by giving them one minute to list different examples, fed back to the rest of the class for consideration.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: UYSEG

**References**

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